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Establishment and Management of Birdsfoot Trefoil in Ohio

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ESTABLISHMENT AND MANAGEMENT OF BIRDSFOOT TREFOIL IN OHIO

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INTRODUCTION

Much of the early research on trefoil in Ohio was directed at problems of establishment. Obtaining satisfactory stands was generally considered difficult, although once established it appeared to be a long-lived perennial legume. Since the early 1950's trefoil has been recognized as a short-lived legume in most areas of Ohio south of 40° North latitude. It is adapted on well drained soils of northeastern Ohio and will persist on many soils that are too wet or too acid for alfalfa.

The experiments reported in this publication were conducted during the period 1952-1963. The principal experimental site was the Ohio Agricultural Experiment Station with other experiments at Substations in eastern Ohio, as indicated. These investigations were concerned with problems of establishment and management of birdsfoot trefoil (*Lotus corniculatus L.*).

EXPERIMENT 1: RATE OF SEEDING

Birdsfoot trefoil was seeded in the field at rates of 2, 4, 6, 8, and 10 pounds per acre of imported European broadleaf along with 1 pound of timothy, both by band seeding and by the conventional broadcast method. Five hundred pounds per acre of 3-12-12 fertilizer was applied during band seeding and was drilled into the seedbed prior to broadcast seeding. Oats were drilled through every other spout of a grain drill at a rate of 2 bushels per acre. The oat crop was harvested by combine, the stubble clipped and the straw removed.

Data shown in Table 1 represent an average of two independent estimates of ground cover made on October 27 of the seeding year. Percent of ground area covered is an indication of vigor and stand. The stand of trefoil increased as rate of seeding increased throughout the entire range. More vigorous plants, as well as higher population resulted from band seeding. Dry matter production in the year following seeding (Table 1) showed a gradual increase in yield as the seeding rate approached 10 pounds per acre. There was no yield difference between band seeding and broadcast.

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TABLE 1.—Ground Cover in Fall of Seeding Year and Yield of Dry Matter in Second and Third Harvests the First Hay Year (Average of 5 Replications).

Seeding Rate			Percent of Area Covered by Birdsfoot Trefoil			Dry Matter Production
			Band Seeded	Broadcast Seeded	Average	
						T/A
2 lb/A			11	7	9	1.16
4 lb/A			20	17	18	1.22
6 lb/A			42	26	34	1.35
8 lb/A			53	33	43	1.44
10 lb/A			66	58	62	1.46
Average			39	28	—	—
L.S.D.	.05	.01				.05
Seeding Rate	7%	9%				.15
Seeding Method	—	9%				

EXPERIMENT 2: METHODS OF INOCULATION

Imported broadleaf birdsfoot trefoil was seeded in the field at 4 pounds per acre with timothy at 1 pound by band seeding. Five hundred pounds per acre of 3-12-12 was applied at time of seeding on April 28. Inoculation was applied to the seed immediately before planting. Oats at one bushel per acre were seeded using a grain drill with every other drill spout stoppered.

Table 2 shows the various methods of inoculation with the results obtained from two independent ratings on October 27 of the seeding year. The need for some inoculation other than with soil suspension was shown. The seed should be moistened before applying commercial inoculant. Dry matter yields the year following seeding were not affected.

EXPERIMENT 3: METHODS OF INOCULATION

A greenhouse sand culture experiment was used in order to study the source of inoculant and method of its application. Treatments and inoculant sources were the same as in the preceeding field experiment.

A summary of the data from experiment 3 is shown in Table 3.

Treatments A and B were significantly lower in top-growth production at each harvest as well as in root production after the last cutting.

TABLE 2.—Effect of Method of Inoculation on Ground Covered by Trefoil in Fall of the Seeding Year (Average of 5 Replications).

	Method	Percent of Area Covered by Birdsfoot Trefoil
A.	No inoculation.	2.5
B.	Inoculated with soil suspension from old trefoil stand.	4.6
C.	Inoculated with soil suspension plus commercial inoculant.	12.8
D.	Seed moistened with water-commercial inoculant applied.	10.2
E.	Seed moistened with saturated sugar solution-commercial inoculant applied.	10.7
F.	Commercial inoculant applied to dry seed.	7.4

L.S.D.	.05	.01
	3.2%	4.4%

TABLE 3.—Top and Root Production of Imported Birdsfoot in Four Harvests as Affected by Inoculation. (Greenhouse Experiment) Grams Per Pot.

	Treatments						L.S.D. 5%	CV
	A	B	C	D	E	F		
Tops First Cut	5.2	6.4	13.2	14.5	13.1	12.5	1.3	12.0
Tops Second Cut	5.7	7.9	11.9	12.4	12.0	11.0	1.4	12.7
Tops Third Cut	12.8	16.5	22.5	21.6	22.4	21.9	1.3	4.1
Tops Fourth Cut	4.2	5.3	7.7	7.5	7.5	7.5	1.2	18.2
Root Weights	5.3	6.3	10.6	10.2	9.6	9.4	1.7	18.6

EXPERIMENT 4: RATE OF APPLYING COMMERCIAL INOCULANT AND TIME OF PLANTING BIRDSFOOT TREFOIL AFTER INOCULATION

In a greenhouse gravel culture experiment three rates of commercially prepared inoculant were used: (1) recommended; (2) two times recommended; and (3) ten times recommended quantities. Times of planting for each of the above rates were (a) immediately, (b) 4 hours, (c) 8 hours, and (d) 24 hours after inoculating the dry seed. In a second series of treatments sugar-water was used to moisten the seed. The inoculated seed was allowed to remain exposed in the greenhouse until planting. Imported birdsfoot seed was planted, covered with ¼ inch of sand and kept moist until germination.

TABLE 4.—First Cutting Dry Matter Production of Imported Birdsfoot as Affected by Inoculation. Grams Per Pot.

Rate of Inoculation (times normal)		N	2N	10N	L.S.D. 5%
Starting with dry seed		9.1	9.6	12.1	1.0
Starting with moist* seed		8.2	8.7	9.5	.9
Hours between Inoculating and Planting	**0**	**4**	**8**	**24**	**L.S.D. 5%**
Starting with dry seed	10.4	11.0	10.3	9.4	N.S.
Starting with moist* seed	7.8	8.0	8.8	8.8	1.0

*Seed was moistened with saturated sugar solution before adding commercial inoculum.

Data on dry matter production from four harvests followed by root harvest are shown in Table 4.

In both experiments, an increase in dry matter appeared to be caused by increased amounts of inoculant. A second harvest showed a similar response for dry seed, but not for the moist seed experiment. Differences between rates of inoculant were not significant in either experiment after the second harvest. Notwithstanding the apparent increased production from exposing the moist seed, it is assumed that there was not a serious deleterious effect from exposing the seed after inoculation for a period up to 24 hours. This is in contradiction to recommended practice. The rate of inoculant x time of planting interaction was not significant. Root production, measured after the fourth cutting, was not affected by the imposed treatments. Nitrogen determinations made on the fourth-cutting top-growth showed no treatment effect on total nitrogen content.

EXPERIMENT 5: METHODS OF SEEDING BIRDSFOOT TREFOIL-LADINO

This experiment was designed to determine the effect upon birdsfoot trefoil of (1) the oats companion crop and (2) variable systems of incorporating a second legume (Ladino clover) into the stand. The legume seedbox of a grain drill was sectioned so that the seed mixture for each seed spout could be independently controlled. Field plots were band seeded with and without a companion crop of oats using 500 pounds of 3-12-12 per acre. Birdsfoot trefoil was seeded at the rate of 4 pounds and timothy at 1 pound per acre in each treatment. Ladino clover was seeded at one pound per acre.

TABLE 5.—Methods of Seeding Birdsfoot Trefoil-Ladino with and without Oats.

Treatment	Percent of Area Covered by Birdsfoot Trefoil[1] Without Oats	With Oats	Average
Birdsfoot Trefoil in each row	29	28	29
Trefoil and Ladino in alternate drill rows	21	22	22
Two drill rows Trefoil, 1 Ladino	31	20	26
Three drill rows Trefoil, 1 Ladino	34	19	27
Trefoil and Ladino mixed in each row	26	15	20
Average	28	20	—

L.S.D. for companion crop $P > .05 = 4$ percent
Difference among treatment means not significant

[1]Average of 3 replications

Two independent visual estimates of the percent of ground cover with birdsfoot trefoil were made in the seeding year on October 27. The data obtained are shown in Table 5. There was a tendency for more trefoil coverage where every row was seeded. The percent of trefoil coverage decreased as Ladino clover was introduced but this trend was not significant. A better trefoil stand was obtained when seeded without a companion crop.

EXPERIMENT 6: COMPANION CROP ROW SPACING

Companion crop row spacings of 7 versus 14 inches were compared in three tests conducted at the Ohio Agricultural Experiment Station in 1956-'57-'58. Wheat and oats were used in addition to winter barley and spelt. Barley and spelt were drilled in 7-inch rows only. Birdsfoot trefoil was band seeded using each 7-inch row, or broadcasted as early as possible in the spring. On fall sown grains the date of broadcasting trefoil was in March while on spring oats the band seeding date was usually mid-April.

First cutting dry matter production in the first year after seeding showed no disadvantage to either row spacing (Table 6). In 1957, the only year in which a significant difference occurred, there was an advantage for the 14-inch row width of the oat companion crop. More weeds were observed in the seeding year in the wider companion crop rows. Timely mowing however gave adequate weed control.

In those tests where wheat, spelt, and winter barley were included, the legume established essentially the same with each of the fall-seeded cereals (data not shown).

TABLE 6.—First Cutting Dry Matter Yields of Birdsfoot Trefoil Seeded in 7- versus 14-Inch Row Spacings of Oats and Wheat.

Companion Crop	Harvest Year	Row Width in Inches 7	14	Average
		T/A	T/A	T/A
Wheat	1956	36	.20	.28
	1957	.77	.87	.82
	1958	2.09	2.14	2.11
	Average	1.04	1.07	1.06
Oats	1956	.28	.22	.25
	1957	.91	1.33	1.12
	1958	1.94	1.94	1.94
	Average	1 04	1.16	1.10

In the 1956 test there was considerable grassy weed growth resulting from a previous sod which obscured the results. In both 1957 and 1958 good trefoil stands were obtained in wheat despite rather heavy growth of that crop. This is frequently not the case with seedings made in wheat.

EXPERIMENT 7: BIRDSFOOT COMPATABILITY WITH GRASSES

Imported birdsfoot was seeded in 1954 with several grasses. Excellent stands were established using southern type brome, northern type brome, common orchardgrass, S-37 orchardgrass, common timothy and Kentucky bluegrass. The plots were harvested four years under a meadow type management. The first cutting was taken during early June and thereafter on a 6-8 week schedule. Optimum fertility was maintained.

The most significant point brought out by these data is the uniformity of trefoil remaining in each association in the final aftermath and growth of 1958.

It appears that established birdsfoot can compete successfully with these grass species under meadow management. The largest yield differences occurred in the first cutting. They were relatively uniform thereafter. Furthermore, variation in botanical composition was high in the first harvest. Percent of birdsfoot in the first cutting was usually as low as 20 percent in the common orchardgrass association and 50 percent or more with Kentucky bluegrass and S-37 orchardgrass.

TABLE 7.—Average Dry Matter Production of Birdsfoot Plus Grass by Cuttings During Experimental Period 1955-58 and Percent of Birdsfoot in the First and Second Cutting of 1958, the Fourth Harvest Year.

					Percent Birdsfoot* 1958	
Birdsfoot Seeded with	1st Cut	2nd Cut	3rd Cut	Total	1st Cut	2nd Cut
	T/A	T/A	T/A	T/A		
Kentucky bluegrass	1.78	1.32	.91	4.01	47	38
Common timothy	1.98	1.34	.83	4.15	32	38
Southern bromegrass	2.03	1.32	.80	4.15	56	33
Northern bromegrass	1.85	1.31	.80	3.96	47	35
Common orchardgrass	2.14	1.27	.84	4.25	21	40
S-37 orchardgrass	1.76	1.25	79	3.80	59	34

*Calculated from nitrogen percentage using the constituent differential method of estimating species composition.

There was no important difference in first cutting botantical composition between northern and southern bromegrass and timothy.

EXPERIMENT 8: PASTURE RENOVATION WITH BIRDSFOOT TREFOIL

The purpose of this investigation was to determine the shortest safe interval between spraying and seeding. Two chemicals were used at two rates each. These were dalapon (2,2-dichloropropionic acid), as the sodium salt, 85 percent, at 7 and 14 pounds per acre, and amitrol (3-amino-1,2-4-triazole) was used at 4 and 8 pounds of active ingredient per acre. Two tests were conducted, one at the Southeastern Ohio Substation in Meigs County near Carpenter, Ohio, and the other at the Ohio Agricultural Experiment Station at Wooster, Ohio. Spray applications in both experiments were made from April 5 to April 20. Seeding and spraying dates were varied to minimize weather effects. Vigorous bluegrass sods were used in both cases. A weighted disk was used to work the sod five days after each spray treatment and again, where possible, just prior to seeding. Imported birdsfoot trefoil, 8 lb/A, was band seeded uniformly over all plots of each replication with 500 lb/A of 0-20-20. Plant counts were made 4 to 6 weeks after seeding to determine the number of vigorous trefoil plants per square foot. In all cases the kill of bluegrass was essentially complete. Evaluation of grass recovery was made the following spring. Considerable growth of broadleaf weeds developed during the growing season.

The data represent averages of five random counts per plot using a one foot square frame. There was no evidence of toxicity from the

TABLE 8.—Number of Birdsfoot Trefoil Plants Per Square Foot 4-6 Weeks After Seeding; as Affected by Rate of Herbicide and Spraying Interval and Seeding.

Treatment lb/A Acid Equivalent	Meigs County[1] Intervals*				Wooster, Ohio[2] Intervals*		
	5	10	15	Avg.	7	14	Avg.
Dalapon-5.2	7.6	8.0	9.7	8.4	24.0	16.7	20.3
Dalapon-10.4	7.5	8.2	8.5	8.0	26.3	23.3	24.8
Average	7.5	8.1	9.1	8.2	25.2	20.0	22.5
Amitrole-4	2.8	2.2	4.0	3.0	9.4	7.0	8.2
Amitrole-8	1.1	1.0	1.7	1.3	3.4	2.2	2.8
Average	1.9	1.6	2.8	2.1	6.4	4.6	5.5
Grand Average	4.7	4.8	5.9	5.1	15.8	12.3	14.0
L.S.D. between:							
chemicals at 5%				4.9			6.1
intervals				N.S.			2.4
rates within chemicals				N.S.			3.4

*Number of days between spraying and seeding.

[1]4 replications.

[2]3 replications.

highest rate of dalapon five or seven days after spraying (Table 8). This property of dalapon is of significance because of the necessity of seeding trefoil as early in the spring as possible. A delay of three to five weeks might mean the difference between success and failure with a trefoil seeding. This is especially true when seeds of many broadleaf weeds are present in the treated soil. On virtually all renovation plots in these and other tests over Ohio there was a very rapid encroaching of broadleaf weeds after the bluegrass was eliminated. These weeds were predominately plantain (*Plantago lanceolata* and *P. rugelii*) and dandelion (*Taraxacum officinale*) with varying amounts of annual broadleaf plants. It was necessary to clip two or more times during the season to control these weeds.

In other locations in Ohio, field tests indicated that amitrole or dalapon applied the previous fall to permanent pasture sod permitted satisfactory trefoil establishment.

The disk harrow was the only tillage implement used in these tests. Following each herbicide treatment a weighted disk was used five days after spraying. The sod was thoroughly loosened in several trips over the plots. Additional disking operations were performed as permitted

TABLE 9.—Percent Stand (Visual Estimate) of Kentucky Bluegrass in Tilled and Un-Tilled Areas Remaining in the Fall of 1956 Following Herbicide Treatments Made on October 20, 1955 and April 19, 1956.

Herbicide Rate lb/A Acid Equivalent	Fall Applied		Spring Applied	
	Tillage	No-Tillage	Tillage	No-Tillage
Dalapon-10			Trace	75%
Dalapon-5	Trace	45%		
Dalapon-20			Trace	35%
Dalapon-10	Trace	Trace		
Amitrole-2			Trace	90%
Amitrole-4	Trace	30%		
Amitrole-4			Trace	60%
Amitrole-8	Trace	10%		

by the longer intervals between spraying and seeding. In the Wooster test there was an indication that the increased number of diskings between spraying and seeding resulted in a slightly lower stand of trefoil plants. This was not apparent at the southeastern Ohio test. In other words, a lesser amount of tillage on the 7-day interval left a firmer seedbed which may have meant less coverage of seeds and earlier germination.

Table 9 summarizes data taken in a field test at the USDA Soil and Water Conservation Research Station at Coshocton, Ohio. Duplicate plots were laid out in the fall of 1955 for spraying to compare fall and spring treatments. Estimates were made in the fall of 1956 of bluegrass stands following the 1955 fall and 1956 spring treatments. The main point brought out in these data is effect of tillage on percent of bluegrass kill, both fall and spring. All tillage plots were disked thoroughly 5 to 10 days after spraying and fall sprayed plots were disked again in the spring prior to seeding. The bluegrass kill was almost complete on fall and spring sprayed tillage plots. The heavier fall herbicide rate without tillage also resulted in almost complete kill of bluegrass. The importance of tillage in conjunction with spring applied chemicals is quite apparent even at heavier rates.

The stand of trefoil obtained by band seeding in this test was variable and inconclusive but indications were that satisfactory stands of trefoil can be established with fall applied herbicide without tillage. On the fall-treated, no-tillage plots, a 50 to 80 percent trefoil stand was obtained.

In summary these data show the possibilities of using herbicides in seedbed preparation for birdsfoot trefoil. Proper use of available materials will suppress competing vegetation sufficiently to permit better stands of trefoil with a minimum of cultivation. Dalapon can be used effectively as either a spring or fall treatment. It lends itself readily to spring applications because of its low toxocity to birdsfoot trefoil seedings. On the other hand amitrole is probably best applied in the fall if spring seeding is intended.

EXPERIMENT 9: HARVEST SCHEDULES FOR BIRDSFOOT TREFOIL-ORCHARDGRASS

European birdsfoot trefoil was band seeded with commercial orchardgrass (early maturing) and S-37 orchardgrass (late maturing) on a Wooster silt loam soil in 1954. A split-split-plot design consisting of whole plots to accomodate four dates of first cutting on a random arrangement within each block was used with 5 replications. Each whole plot was subdivided to permit two lengths of interval between harvests. The subplots were further divided to accommodate the two strains of orchardgrass. Six- and 8-week intervals were used subsequent to 4 dates of first-cutting as follows: (1) May 13, (2) May 20, (3) June 1, and (4) June 13.

The treatments were continued 4 years (1955-1958) and a uniform harvest made in 1959 gave a measure of residual treatment effects. Dry matter production, protein production, botanical composition, and stand-life were recorded.

Soil fertility was maintained at high levels and soil pH was held at 6.5 or above. Insect damage was kept to a minimum by spraying. Botanical compostion of the hay in 1957 and 1958 was calculated using nitrogen percent values of the hay and each hay component. Weeds were not a problem. The start of the harvest schedules indicated above is approximate. Samples from each plot were saved for moisture and other determinations. Crude protein was determined on all treatments in 1957-1958. Birdsfoot trefoil density was measured in 1959 using an inclined point quadrat.

Significant total yield differences were obtained between dates of first harvest with the exception of the May 13 and May 20 cuts (Figure 1). The 8-week interval produced significantly more than the 6-week interval for each starting date. The interaction between date-of-first-cut and interval-between-cuts was highly significant.

Common orchardgrass-birdsfoot produced 0.22 tons per acre more dry matter annually than the S-37 orchardgrass-birdsfoot (Table 10).

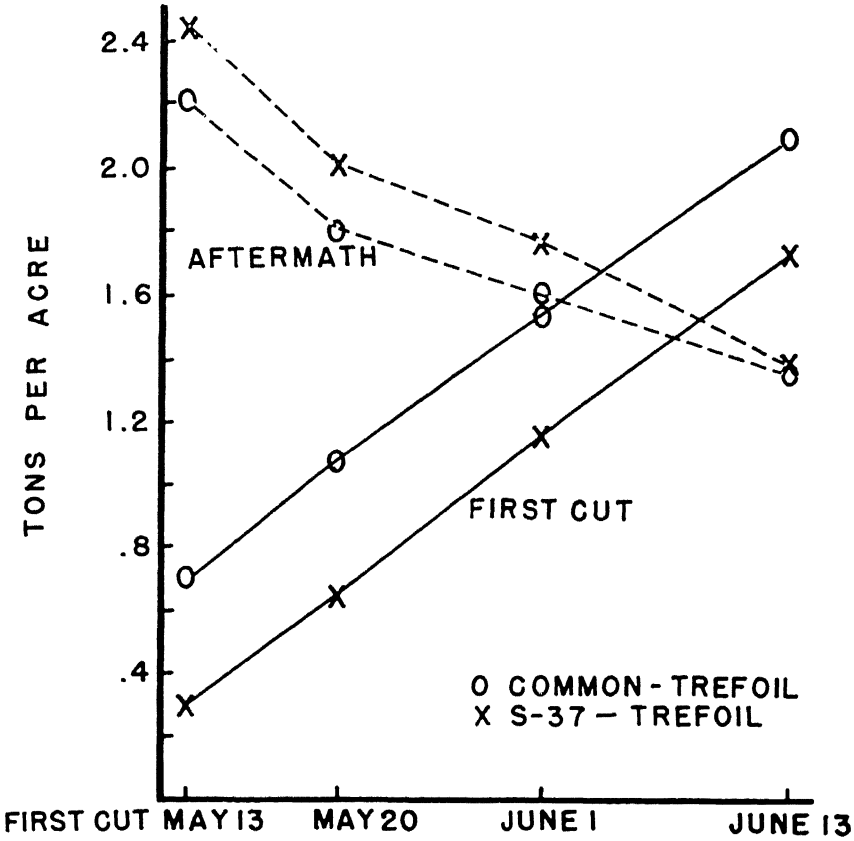

Fig. 1.—Dry matter production of birdsfoot trefoil-orchardgrass in first cutting and aftermath (1955-1958).

TABLE 10.—Dry Matter Production of the Orchardgrass-Trefoil Associations for First Cutting and Aftermath; 4-Year Average, 1955-58.

Orchardgrass Strain	Tons Per Acre		
	First Cutting	Aftermath	Total
Common	1.37	1.74	3.11
S-37	.96	1.92	2.88

TABLE 11.—Percentage Birdsfoot Trefoil in the First Cutting (1955-58).

Grass Variety	Percent Trefoil in First Cutting							
	May 13		May 20		June 1		June 13	
	Cutting Interval (weeks)							
	6	8	6	8	6	8	6	8
Common-orchardgrass	16	13	19	17	25	19	29	33
S-37 orchardgrass	34	27	37	38	37	43	45	45

First-harvest yields for the 6- and 8-week interval treatments did not differ significantly.

Two factors caused significant differences in protein production. These were (1) cutting interval and (2) the interaction, cutting interval x first-cutting date. The 8-week interval gave highest production of protein at each first-cutting date except the May 13 date.

The percent of birdsfoot trefoil in the first-cut hay was affected by date of harvest and by orchardgrass strains. Percent of birdsfoot for the first cutting only is shown in Table 11. The birdsfoot trefoil component of the first-cutting of hay amounted to 0.10, 0.21, 0.40 and 0.72 tons per acre for the May 13, May 20, June 1, and June 13 first-cut dates, respectively. Subsequent harvests did not show treatment variation in the amount of birdsfoot.

A uniform harvest was made the fifth hay season to indicate residual treatment effects. A yield interaction was found between date of first-cutting and the interval between cuttings (Table 12). Common orchardgrass-birdsfoot produced 0.45 tons per acre more dry matter than the S-37 birdsfoot trefoil association. Residual effects resulting from date of first-cut also differed significantly.

TABLE 12.—Yield of Birdsfoot Trefoil-Orchardgrass on June 1, 1959, and Density of Trefoil Plants 5 Weeks Later.

Date of First Cut	Tons Per Acre		Density of Trefoil*	
	Cutting Interval (weeks)		Cutting Interval (weeks)	
	6	8	6	8
May 13	1.04	1 10	17.8	14.6
May 20	1.30	1.17	24.5	18.1
June 1	1.19	1.14	19 3	18.5
June 13	1 05	1 25	17.4	21.2

*Average number of strikes with a 10-point quadrat.

Birdsfoot trefoil density as measured by the inclined point quadrat was determined five weeks after the uniform hay harvest on June 1. Table 12 shows the interaction of first cutting-date x cutting-interval. The average density count for S-37 orchardgrass-trefoil was 20.0; for common orchardgrass-trefoil, 17.9 hits per location.

The dry matter producing capacity of an orchardgrass-trefoil association is greatest in the spring. The highest hay yields were obtained with those treatments (1) which permitted the longest spring growth period and (2) which had the longest growth interval between harvests. The treatments used in this experiment were not equal in terms of length of growing season. Treatments with the same date of first-cut utilized a longer portion of the growing season if cut 3 times on an 8-week interval rather than 3 times on a 6-week interval, accounting in part for the interaction date-of-first-cut x cutting interval.

The yield superiority of the common orchardgrass association was evident only with the first harvest each season. The S-37 association was consistently higher yielding in aftermath harvests.

In all plots, orchardgrass had the appearance of partial nitrogen deficiency. An apparent explanation for this is that birdsfoot trefoil is incapable of causing atmospheric nitrogen to be fixed in quantities that would permit maximum growth of the associated orchardgrass (Figure 2). Protein production tended to be constant for all treatments having a common cutting interval. The greater production of protein with 8-week versus 6-week treatment intervals may have been due to the longer season of growth mentioned above. Since trefoil stands were not strongly affected by treatment, the amount of nitrogen fixed, hence available to stimulate orchardgrass growth, was largely a function of time.

Birdsfoot trefoil, which starts spring growth later than the associated grass, made up a larger proportion of the hay where the first-cutting was made later in the spring. While the percent of trefoil for the two grass strains differed, the quantity of trefoil in weight of dry matter in each harvest did not differ signiifcantly. This was true also for subsequent harvests.

While there were annual fluctuations in the growth of birdsfoot trefoil, visual observations indicated no important plant population changes due to treatment. Trefoil stand as measured with the inclined point quadrat showed higher trefoil density with the less vigorous S-37 orchardgrass. This difference of density was probably affected by the nature of growth or competition from the associated grass. The less vigorous S-37 may have contributed to a higher degree of trefoil tillering but not necessarily to higher plant population.

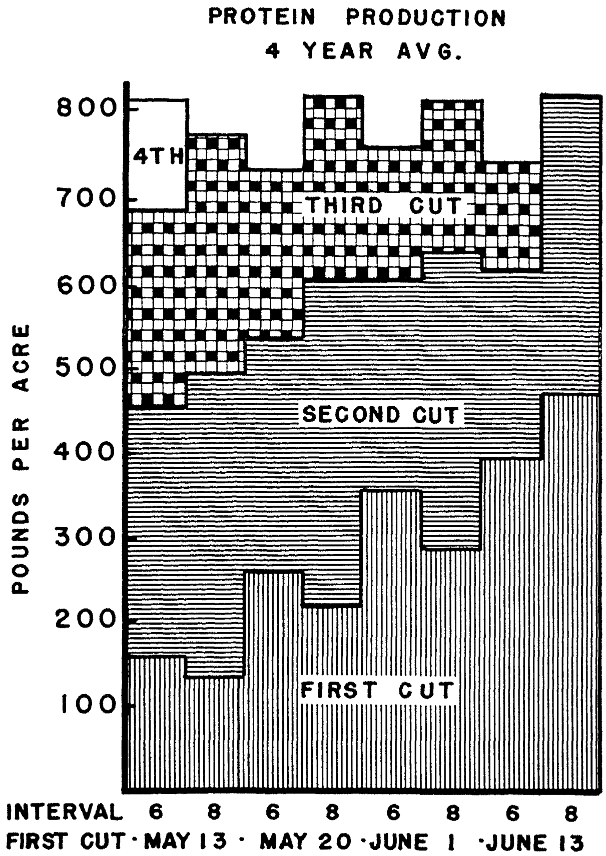

Fig. 2.—Average annual protein production by cutting of birdsfoot trefoil-orchardgrass for the 1957, 1958 seasons.

The residual treatment effects as measured by yield (Table 12) were affected by several factors. Probably most important was the date of final cutting the preceding year. In each interval comparison, that treatment which was cut later in the previous fall produced significantly less forage in June 1959.

The residual treatment effects as measured by density of birdsfoot trefoil (Table 12) show a trend similar to residual yield data. A late first cutting (June 13) combined with an 8-week interval between harvests favored birdsfoot trefoil density. Date of late cutting also had an important effect on density of birdsfoot trefoil but is confounded with other treatment effects.

EXPERIMENT 10: SPRING AND FALL MANAGEMENT OF BIRDSFOOT TREFOIL

Imported birdsfoot was seeded by spring-broadcasting on a Canfield silt loam soil at 8 pounds per acre. A split plot design was used with 3 dates of first cut and 3 dates of final cut as follows: (a) start early in May when growth is 3-5 inches, (b) two weeks after (a); and (c) four weeks after (a). Three dates of last cut were observed with each of the above dates of first harvest as follows: not later than September 1; not later than October 1; and not later than November 1. Intervals between harvests varied from 3 to 5 weeks.

The treatments were continued 3 years and a trefoil density measurement made after the third harvest year gave an indication of accumulated treatment effects (Table 13). Dry matter production was essentially the same for all treatments for two harvest years. Third year production showed the accumulated effects of treatment.

Harvesting after September 1 was harmful to the trefoil (Table 13). Yield data show the effect of treatments on both population and

TABLE 13.—Third year Dry Matter Production of Birdsfoot and Final Stand-Density Measurement by Inclined Point Quadrat.

		Last Cut Not Later Than			
		Sept. 1	Oct. 1	Nov. 1	Avg.
First cut early May	Tons/Acre	2.69	1.90	1.82	2.14
	Density*	13.5	5.8	3.9	7.7
First cut mid-May	Tons/Acre	2.07	1.85	2.05	1.99
	Density	11.9	3.9	3.4	6.4
First cut late May	Tons/Acre	2.81	2.23	2.34	2.46
	Density	19.7	5.5	2.8	9.3
Average	Tons/Acre	2.52	2.00	2.07	—
	Density	15.0	5.0	3.4	—
L.S.D. First cut	Tons/Acre	5% = 0.31	1% N.S.	C.V. 19.0%	
	Density	5% = N.S.		C.V. 56.9%	
L.S.D. Last cut	Tons/Acre	5% = 0.14	1% = 0.19	C.V. 9.3%	
	Density	5% = 2.5	1% = 3.4	C.V. 47.9%	
Interaction	Tons/Acre	Significant at 1%.			
	Density	Not significant.			

*Average number of hits with a 10-point quadrat on May 25 of fourth hay-year.

plant vigor. The combination of early first cut and late final cut resulted in the lowest production the third harvest season. This is a reflection of the previous two years of cutting. The quadrat count data reflect the accumulative effects of three harvest seasons and although similar to third year dry matter yields, the detrimental effect of late fall harvest in the third season is illustrated in the sharp decline in density (Table 13).

Considering stand density as the indicator of treatment effects, one can conclude that (1) time of last harvest overshadowed all other effects, (2) if final harvest was on or before September 1 then bad effects of early spring cutting were reduced, and (3) if last cut was October 1 or November 1 the effect on density was so severe that delaying the spring cut did not compensate the damage.

SUMMARY

The following conclusions are drawn, recognizing that the experiments were limited in number and location within the state:

1. Seeding rates of 4-6 pounds per acre of trefoil will produce adequate ground cover in the seeding year and maximum yields thereafter.
2. Commercial inoculant applied as recommended on the label, preferably with a moistening agent will assure inoculation of trefoil plants. The length of exposure time between applying inoculant and seeding is not critical, but it should be limited.
3. Birdsfoot trefoil is not a vigorous competitor and should not be seeded with legumes such as Labino clover.
4. There is an advantage to band seeding trefoil without a companion crop if weeds are not likely to become a problem. The advantage of wide over narrow row-spacing of the companion crop is not large and there is a possibility of greater weed growth with wide spacing. The preferred companion crop is oats, although considerable success was obtained with wheat and other fall sown grain crops.
5. Once established, birdsfoot trefoil will persist successfully with most of the commonly used grasses in Ohio. As with other legumes however, trefoil should be managed in a manner that will avoid very early spring or late fall harvests. Although yields were reduced, trefoil persisted under a 4-cutting hay management with orchardgrass. This type management would have eliminated alfalfa stands.

6. Herbicides can be used in the successful establishment of trefoil. However, tillage with a disk or plow in addition to herbicides improved the stands of trefoil and gave a better kill of previous sod. Fall treatment with dalapon 5 lbs or amitrole 2 lbs per acre plus tillage permits early spring planting and is preferred to spring application of chemicals. Amitrole should not be used in spring because of toxicity to seedling trefoil.